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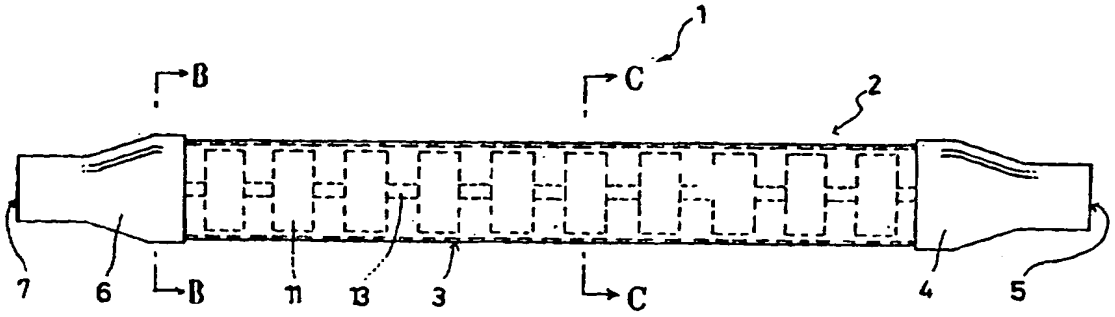

(57) Abstract

The present invention is intended to provide a device for refining fuel oil which can assuredly refine fuel oil for better efficiency, increasing the horse power of engines as well as raising its combustion rate or decreasing exhaust gas. Inside a long, hollow body (3) of a pipe (2) which has an inlet (5) on one end and an outlet (7) on the other are 10 annular magnets (11), which have a smaller outer diameter than the inner diameter of said body (3), so arranged that the polarities of the magnetic poles facing each other are the same; cylindrical shaft bodies (13) which have small magnets (18) arranged in a line inside their inner space are inserted in continuation in the central opening of said magnets (11) and, joined with said inlet (5) and said outlet (7), are retained in the center of said body (3); the gaps between said shaft (13) and said magnets (11) and the gaps between said magnets (11) and the inner surface of said body (3) of said pipe (2) serve as passage for the flow of fuel oil; and springs (12) are inserted in the gaps between said magnets (11) and the inner surface of said body (3); other springs (19) are so fitted that said magnets (11) at both ends can apply force toward the center of said body (3).

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Title of Invention

A Device for Refining Fuel Oil

Field of Techniques

The subject invention relates to a device for refining such fuel oil as heavy or light oil used for airconditioning boilers or engines of ships, automobiles, etc. by virtue of magnetism to improve its fuel efficiency and reduce its exhaust gas.

Prior Arts

Conventional devices **70** for refining fuel oil were, as is seen in Figs. 18 to 20, structures of a long, narrow, hollow, cylindrical pipe **71**, to whose outer circumferential surface a number of permanent magnets were attached, i. e. a group of pairs of permanent magnets **72** in the shape of an arc of half circle (like horse shoes) wrapping around said pipe **71**, each pair of two half circle magnets **72** facing each other being placed side by side in parallel along the length of said pipe **71** with no gaps in between; the polarities of said magnets **72** facing each other were different; said slim pipe **71** wrapped around with permanent magnets **72** was inserted in, and attached to, a casing **75** of a shape of hollow cylinder.

Because these permanent magnets **72** were attached to the outer circumferential surface of said pipe **71**, the density of the magnetic flux was heightened, and the part of magnets, whose intensity of magnetic field was strong, being situated on the outside of said pipe **71**, the intensity of magnetic field working upon the inside of said pipe **71** was strong, while the direction of the magnetic direction was steady.

As a consequence, the effect of refining by magnetism on the fuel oil flowing inside said pipe 71 was small. As the fuel oil flowed in a straight line the time it passed the magnetic field had to be short, the refining effect kept small.

Outline of Invention

The purpose of the present invention is to solve such problems given above of conventional refining devices, by providing a new device for refining fuel oil, which can not only ensure a precise and efficient refining but raise the combustion efficiency, reduce exhaustion gas, and add to the horse power of the engine also.

Brief Description of Drawings

Fig. 1 is a frontal view for illustration of Example 1 of embodiment.

Fig. 2 is its right side view.

Fig. 3 is a sectional view of A-A in Fig. 2.

Fig. 4 is a sectional view of B-B in Fig. 1

Fig. 5 is a sectional view of C-C in Fig. 1.

Fig. 6 is a blow up of part of Fig. 3.

Fig 7 is an illustration to show the line of magnetic force in Example 1 of embodiment.

Fig. 8 is an illustration to show the flow of fuel in Example 1 of embodiment.

Fig. 9 is an illustration to show the use accoding to Example 1 of embodiment.

Fig. 10 is a vertical section along the lengthwise direction in Example 2 of embodiment.

Fig. 11 is a cross section in Example 2.

Fig. 12 is a vertical section cut along the lengthwise direction in Example 3 of embodiment.

Fig. 13 is a vertical section cut along the lengthwise direction in Example 4 of embodiment.

Fig. 14 is a vertical section cut along the lengthwise direction in Example 5 of embodiment.

Fig. 15 is a cross section in Example 5 of embodiment.

Fig. 16 is a vertical section cut along the lengthwise direction in Example 6 of embodiment.

Fig. 17 is a cross section in Example 6.

Detailed Description of Invention

The present invention is of a fuel oil refining device **1**, characterized by a plurality of magnets **11**, arranged in a chamber, which serves as channel **20** for passage of fuel oil, with an inlet **5** on one end and an outlet **7** on the other; wherein said plurality of magnets **11** are placed close together, the magnetic poles placed opposite facing each other, said chamber made into an inner space of a long, slim, and hollow cylindrical pipe **2**, inside which pipe **2** said plurality of magnets **11** are arranged in parallel along the length of said pipe **2** so that their magnetic poles can be close by and face each other, with the poles of the neighboring magnets **11** facing each other being of the same polarities, openings for flow of oil being given between the outer circumferential surface of said magnets **11** and the inner circumferential surface of said pipe **2**, said openings

made between said magnets 11 and said pipe 2 being inserted with retainers of gaps, said magnets being of an annular structure, said annular magnets 11 each having an opening 11a in the center, a long slim shaft 13 being set inside said pipe so that it can be put through a series of said openings 11a, a gap for passage of fuel oil being left between the inner circumferential surface of said opening 11a prepared in the center of said annular magnets 11 and the outer circumferential surface of said shaft 13, a retainer of gaps being inserted in said gap for passage of fuel oil between said magnet 11 and said shaft 13, said shaft 13 being made of magnetic material, a small magnet 18 being inserted in the center of each gap between the poles of the neighboring magnets 11 in a manner that its poles can face those of said annular magnets 11, said shaft 13 also being made in the form of hollow pipe, and said small magnet 18 being placed inside said shaft 13 placed between said neighboring magnets 11 in a manner that it must face said magnet 11.

The functions-effects of said fuel oil refining device of the present invention, with the structure given above, are explained below:

According to the present invention, because a plurality of magnets 11 are arranged in the chamber of said pipe 2 serving as channel 20 for flow of fuel oil, etc., a majority of the magnetic force lines work on inside the chamber and others, raising the intensity of the magnetic field there.

For this reason, the fuel oil induced into the chamber from the inlet 5 undergoes through great influence of magnetism in the chamber, where the intensity of magnetic field is greater, getting refined into a better fuel oil, its fuel efficiency raised, its exhaust gas to be less, and flows out of an outlet 7.

The fuel oil, in contact with said plurality of magnets, has its course of flow changed, and as it flows while getting stirred at the same time, its time for passage of the chamber gets prolonged, the

time for magnetic influence also getting extended. As the lines of magnetic force exerting influence on the fuel oil extend in various directions, the fuel oil gets all the more influence of magnetism, its refining facilitated, too.

When annular magnets are placed inside the pipe which the fuel oil passes and the poles of the neighboring magnets facing each other are of the same polarities, these magnets repel the ones placed opposite, and the line of magnetic force from each magnet does not extend to the pole of the neighboring magnet opposite it but flows from an N pole to an S pole. For this reason, the line of magnetic force of each magnet concentrates on its opening part, heightening the density of magnetic flux, and the intensity of magnetism inside this opening is made stronger. The opening constitutes the very passage of the fuel oil and thus the fuel oil is brought under strong magnetism.

Moreover, the line of magnetic force of each magnet collides with that of its neighboring magnet in the center of the distance between the neighboring magnets, where the lines of magnetism never mingle but divert to a direction at nearly a right angle to each, heading for the opening or the outer circumferential surface of each magnet, and by the collision of the line of magnetic force forms membranes of concentrated magnetic force lines at a right angle to the direction of the fuel oil's passage, whereby the intensity of the magnetic field in the gap between the neighboring magnets is further strengthened, exerting stronger magnetism on the fuel oil.

When shafts of magnetic material are inserted in a continuous series in the magnetically stronger opening parts **11a** of magnets **11**, the shafts **13** are magnetized by induction of magnets **11**, and by a contribution of these magnetized shafts the magnetism inside the pipe gets more intensified, the magnetic influence upon the fuel oil further raised, its refining for better fuel efficiency thus made possible.

In the center of the gap between the mutually closely neighboring magnets a small magnet **18** is placed, its magnetism also is added via the fuel oil to the magnetism inside the pipe chamber, thus the intensity of the magnetic field getting further heightened, the magnetic influence on the fuel oil rises so much.

As the chamber for fuel oil to pass through a long, slim hollow pipe or a tank capable of storing a quantity of fuel oil can serve.

As material for this pipe stainless steel, hard aluminum, etc. are used, and as the form of such a pipe a cylindrical, tricornered, quadrilateral pillar, or many others can be adopted. The length of a pipe can vary according to the number of magnets adopted, but, for example, a pipe with 10 magnets of 20mm in width can be just of a length of 60cm.

As to the positions of the inlet **5** and outlet **7** it is preferable to place them one at either end, when the chamber for passage of oil fuel is the interior of a pipe, and it will be more convenient than otherwise to make an inlet **5** and outlet **7** of material different from the body of the pipe and fix them onto the respective end of a hollow cylindrical pipe. Or else, the inlet and outlet can be fixed onto the main side wall of both ends of a pipe. It is also preferable to sculpt screw grooves on the inside or outside of both the inlet and outlet for convenient fixing or contact with material of such other parts as other pipes for supply of fuel oil , etc.

The fuel oil that passes through the tubular chamber with the inlet **5** and outlet **7** actually passes through the gap between the outer circumferential surface of the magnets **11** and the inner surface of the chamber, or in case that the magnets are of an annular form passes through the inside of the opening **11a** of these magnets, or else, in case a gap is made between the outer circumferential surface of the shaft **13** and the inner circumferential surface of the opening **11a** of magnets, in which a shaft **13** is inserted, passes through this gap.

As for the position the fuel oil passes, it may be through all the above three, or any two combined, or any one of them only.

The force of magnetism varies according to the way magnetism is made use of, but magnets of 500 to 1,500 gauss is effective. Ferritic magnets are resistant to corrosion and are usually adopted. The shape and size of magnets depend on the shape of the chamber and other factors, and their outward looks may be circular, or polygonal, triangular, square, or otherwise.

But magnets are desirable of being annular, the polarities of the neighboring magnets facing each other preferably different. This is in order to concentrate the lines of force of magnetism in the opening made in the center between the magnets where the fuel oil passes, and thus strengthen the intensity of the magnetic field.

This is further preferable, because in such a case it is possible to insert in the opening a shaft of magnetic material or a shaft having a small magnet placed inside, in continuation, thus strengthening the intensity of the magnetic field in the chamber. The shaft can perform prevention of magnets of repellent similar polarities from revolution, or adsorption by bringing their different poles close together through this revolution. As regards the magnets, use of a plurality of magnets with their different poles adsorbed together in one is preferable for use of one with a desirable magnetism attained is better, and use of an indivisible magnet with the desirable capacity of magnetism already attained is also commendable.

The magnets placed near the inlet or outlet had better be kept away from the inlet or outlet by means of a spring **19** or the like so that the area for contact with the fuel oil can be all the larger.

When a gap is prepared between the outer circumferential surface of the magnet and the inside of the chamber for passage of fuel oil, it is good, in order to maintain the breadth of this gap steadily, to place a spirally extending spring past this gap along the

inside of the chamber as a gap retainer, or place a long and slim shaft passable through the gap inside a plurality of chambers, also as a gap retainer.

Examples

Below, examples of the present invention are described, the drawings being referred to when necessary:

In Example 1, shown in Figs. 1 to 9, annular magnets are used; in the opening in the center of these magnets shafts with a small magnet placed inside each, are inserted in continuation, making the polarities of respective opposite poles of neighboring magnets the same; the gap between the outer circumferential surface of the magnet and the inner surface of the pipe and the other gap between the inner circumferential surface of the opening of the magnets and the outer circumferential surface of the shaft are used as channels for passage of fuel oil.

Example 2, shown in Figs. 10 to 11, illustrates a case, where the spring used as retainer of gaps in Example 1 is replaced by a plurality of long and slim shafts.

Example 3, shown in Fig. 12, illustrates a case, where the shafts with a small magnet inside each in Example 1 are replaced by shafts of iron.

Example 4, as shown in Fig. 13, illustrates a case, in which the magnets in Example 1 are placed in a manner that the polarities of the poles of the magnets may be different from those of the magnets neighboring and facing them, and an interval is kept between the neighboring magnets by means of a spacer.

Example 5, shown in Figs. 14 and 15, illustrates a case, where the magnets are annular magnets, and are placed in a manner that the polarities of the poles of the magnet may be the same as those of the magnets neighboring and facing them, while the front of the

outer circumferential surface of these magnets are placed in contact with the inner surface of the pipe, and the opening in the center of the magnets is made the channel for passage of fuel oil, no shafts being used in this case.

Example 6, shown in Figs. 16 and 17, illustrates a case, where a number of gaps are made extended lengthwise inside the pipe of Example 5 for use as channels for passage of fuel oil, while, instead, using magnets of such round bar type as have no opening in the center.

Example 1 (Figs. 1 to 9)

In the fuel oil refining device 1 of the present invention, the pipe 2 is of a cylindrical shape, consisting of a hollow body 3 with an inlet 5 having its inlet pipe 4 on one end and an outlet 7 having its outlet pipe 6 on the other; said body 3, hollow, its outer diameter about 6cm, length about 40cm; said inlet 4, hollow, the shape of a bugle, the diameter of its one end to join with said body 3 of said pipe 2 being about 6cm and that of the other end being about 3.5cm; in the center of the inner circumferential surface of the open end of said inlet 4 is a board with eight passage holes 9 opened in the outer circumferential surface of a hole 8 for insertion of the central shaft 13 attached as a unitary structure; said inlet 5 is the extension of said inlet pipe 4, while said outlet pipe is of the same structure as said inlet pipe 4; said outlet 7 is the extension of said outlet pipe 6, while said hole 8 is a hole for insertion of said shaft 13, and said passage holes 9 are holes for passage of fuel oil; said magnets 11 are each a round one made of three annular ferritic magnets of 7mm in width joined by adsorption, and its outer diameter about 4.5cm, just a bit smaller than the inner diameter of said body 3 of said pipe; the openings 11a of said magnets are formed in the center of said magnets 11; springs 12 placed in the gaps between the outer circumferential surface of said magnets 11 and the inner surface of said body 3 of said pipe retaining the gaps, and they are of stainless steel, the length about that of said body 3 of said pipe; the shaft 13, about 45cm long, is inserted in said opening 11a of said magnet 11,

joins said inlet 4 and said outlet pipe 6, passing through said hole 8 of said inlet 4 and said outlet pipe 6; a head 15 is formed on one end of said shaft 13 to block said insertion hole 8; a big screw member 16 is formed in the outer circumferential surface of the other end of said shaft 13; small magnets 18 are each contained inside said shafts 13; springs 19 are to inwardly engage said magnets 11 on both ends of said body 3 of said pipe; and finally said fuel oil passage channels 20 consist in the gaps between the outer circumferential surface of said magnets 11 and the inner surface of said body 3 of said pipe and the gaps between the inner circumferential surface of said opening 11a of said magnets 11 and the outer circumferential surface of said shafts 13. Now unexplained 21 indicates the south pole; 22 the north pole of said magnet 11; 24 the nut for the bigger screw part 16 of said shaft 13; 25 the elastic packing made of Teflon for both said inlet pipe 4 and outlet pipe 6 placed in contact with the end parts of said body 3 of said pipe; 26 the south and 27 the north pole of said small magnet 18; 28 said spacer between said small magnets; 29 fuel oil; 30 the line of magnetic force; 32 a truck; 33 a driving member; 35 a fuel tank; and 36 a pipe (hose) for feeding fuel oil.

In the fuel oil refining device 1 of Example 1, shown in Fig. 1 to 9, the lines of magnetic force 30 from said magnets 11 and small magnets 18 contained inside said pipe 2 extend in directions various and complex to give rise to an intense magnetic field inside said pipe 2 all the time.

Said device 1 is installed in the middle or the beginning or finishing end of a tank for storage of fuel oil 29 like heavy or light oil, of the pipe connected with an air conditioning boiler or engines for feeding such fuel oil, or of a channel of similar device for supply of fuel oil in a manner that said outlet is faced toward the down stream of oil.

The fuel oil 29 flowing in at said inlet 5 flows into said pipe 2 via said passage hole 9 of said inlet 4 and passes the inner chamber of said pipe through said passage 20 to said outlet 7. The gap

between said neighboring magnets 11 arranged to measure only about 1cm in order to raise the intensity of magnetism in the magnetic field between said magnets to extreme height.

As it flows in said pipe through the gaps between said magnets 11, fuel oil 29 has to flow, getting stirred or agitated, because it comes in contact or collides with said magnets 11 or, led by said springs 12 placed in said passage 20 between the outer circumferential surface of said magnets 11 and the inner surface of said body 3 of said pipe 2, flows in whirls along the inner surface of said body 3 of said pipe 2.

For this reason the time for fuel oil to pass through said pipe 2 gets longer, the fuel oil staying under the influence of said lines 30 of magnetic force extending in various directions the longer, and being in contact with both the north 22 and south 23 poles of said magnets 11, the fuel oil 29 is the more apt to get refined under such favorable conditions.

The fuel oil passing through said device 1 gets its fuel efficiency raised under the strong magnetic influence, its yield of exhaust gas lessened, emission of its bad smell also restrained.

To ascertain this, said device 1 was experimentally installed to a long-distance truck using light oil as fuel in a test run from Fukuoka to Tokyo and back (2380km round trip).

The truck was a Nissan diesel PF6 intercooler-turbo, piston displacement 12503cc, 320HP.

The test run took place on 30 January 1996, in fine weather. The device 1 was installed just above the fuel tank in the left center of the body of the truck, as is shown in Fig. 9.

The oil hose (pipe) 36 had been cut into two at a proper position, and the two had been joined via said device 1 set in between by said inlet 5 and outlet 7.

To see the change after installation of said refining device 1, the exhaust gas was smelled at a distance of about 30cm from the muffler of the truck **32** to be used for the test, before installation of said device 1 before departure for Tokyo.

The exhaust stank so badly that a person was unable to keep his face in it for longer than two to three seconds.

The color of the gas from the exhaust pipe was black at that. Then after installation of said device 1 a similar test was made of the exhaust gas from the muffler, to confirm that the exhaust gas showed no change for the first eight minutes because for the time the fuel oil **29** left in the engine **34** without getting refined by the device burned, but after the leftover exhausted and the refined fuel oil began burning in about eight minutes the black color of the gas from the exhaust pipe disappeared, the gas stinking no longer, and a person could stay with his face close by the muffler for several minutes. Many persons tested with the same results.

The Test Run for Fukuoka-Tokyo, Round Trip for 2380km, showed a consumption of 66*l* of fuel oil.

As the average consumption of fuel oil for the same distance was 850*l* to 860*l* before installation of said device 1 of the present invention, said device 1 meant a saving of fuel oil by 194*l* to 199*l* (23%).

As is seen from the above, installation of said device 1 has made it possible to improve the combustion efficiency of fuel oil and the capability of engine in terms of horse power along with restraint of yield of exhaust gas, thus leading to contribution to prevention of contamination.

Moreover, with the improvement of horse power, a comfortable driving with little fatigue on the part of the driver was allowed, because smooth driving was possible even on a hilly road

which was apt to make driving weary. For this reason a real comfortable driving, as on a high-priced high horse-power truck, was possible.

Test with Airconditioning Boiler

Said device 1 was tested on the following boiler:
Period of time: January 1996, for 13 days;
Type of Boiler: *Showa-Tekko*-made sectional boiler of cast iron (Model S 8-10S);
Output Capacity: Rating 1,200,000 kcal/h;
Fuel Oil: A diesel;
Combustion Quantity: 165.8*l*/h;
Burner: *Showa*-made oil burner, H-Type (Model H-160-A).

The boiler (unillustrated) was emptied, and then the relation of time and fuel efficiency was tested as required to raise the steam pressure to 1.5kg/cm^2 from temperature of water 8°C.

Before installation of said device **1** the time was 50 minutes and the consumption of fuel oil, 145*l*, but after installation of said device 1 the time was 41 minutes and the consumption of fuel oil, 119*l*.

Hence the installation of said device brought forth a 20% improvement respectively in time and fuel oil spent, compared with pre-installation time. The smoke exhausted from the chimneys before installation of said device was a little bit black, seen with the naked eye, but after installation of said device no black smoke was observable by the naked eye.

Example 2 (Figs. 10 and 11)

In Fig. 10, **41** is a bar of about 2mm in diameter.

Example 2, as shown in Figs. 10 and 11, was an instance, wherein, instead of the spring **12** used as the retainer of a gap, or

spacer, in Example 1, a plurality of long slim bars **41** were placed inside said body **3** of said pipe at a certain interval in between.

As regards the rest of symbols, construction, functions-effects, all are the same as in Example 1.

Example 3 (Fig. 12)

42 in Fig. 12 is a shaft, made of a long slim iron bar, a magnetic material.

Example 3, shown in Fig. 12, was a case, wherein, instead of said shaft **13** with small magnets **18** inside, used in Example 1, iron bars made in a similar form to said shaft **13** were used as shaft bodies **42**.

Said shaft bodies **42** were magnetized under the induction by the magnetism of the neighboring magnets **11**, **18**, the magnetic field of said magnetized shaft bodies **42** adding to the magnetism inside said pipe 2, raising its intensity ever higher.

The other symbols, construction, functions-effects are all the same as in Example 1 above.

Example 4 (Fig. 13)

43 in Fig. 13 is a spacer of a cylindrical form.

Example 4, shown in Fig. 13, was an instance, where said magnets **11** in Example 1 were so arranged that the polarities of the poles of said magnets **11** might be different from those of the other magnets neighboring with and facing opposite them.

Cylinder-formed spacers were inserted in the positions of shafts **13** between said magnets **11** lest the neighboring magnets **11** should not adsorb each other.

The other symbols, construction, and functions-effects are all the same as in Example 1 above.

Example 5 (Figs. 14 and 15)

44 in Fig. 14 indicates annular magnets whose outer diameter is the same as the inner diameter of said body 3 of said pipe 2.

Example 5, as shown in Figs. 14 and 15, illustrates a case, wherein, instead of said magnets 11 used in Example 1, annular magnets 44 whose outer diameter was the same as the inner diameter of said body 3 of said pipe 2 were in use, said springs 12 and said shafts 13 used as retainers of gaps were removed, and these annular magnets 44 were so placed that their outer circumferential surfaces came into contact with the inner surface of said body 3 of said pipe 2, while making the central openings of said annular magnets 44 available for passages of fuel oil 29.

The other symbols, structure, and functions-effects are the same as those in Example 1.

Example 6 (Figs. 16 and 17)

45 in Fig. 16 indicates a plurality of grooves formed in the inner surface of said body 3 of said pipe 2 along its length.

Example 6, as shown in Figs. 16 and 17, illustrates a case, wherein, replacing said annular magnets 44 used in Example 5 with other magnets shaped in the form of a column with no opening in the center, a plurality of grooves 45 were formed in the inner surface of said body 3 of said pipe 2 along the length of said pipe, and said grooves 45 were used for passage of said fuel oil 29.

The other symbols, structure, and functions-effects are the same as in Example 5.

Below, the functions-effects of the present invention are given:

As has been seen in the above, because, in the present invention, a plurality of magnets are placed inside the chamber, which serves as passage of fuel oil, the density of magnetic flux there is high, and because the poles of magnets which are of the strongest magnetic field are situated in the passage for fuel oil it is possible to raise the intensity of the magnetic field in the chamber where the fuel oil passes.

The fuel oil gets greatly influenced by magnetism as it flows while in contact with the poles of these magnets and as its direction of flow changes under the influence of the magnetism it flows getting stirred and agitated in the chamber, whereby the time it flows through the chamber is naturally prolonged, the time for magnetism to affect the fuel oil also getting extended.

And as the lines of magnetic force extend in various directions, the directions of magnetic field in the chamber cross the other lines of magnetic force extending in many other directions, whereby the functions-effects of magnetism which the fuel oil undergoes are also improved a great deal.

For all these reasons it is possible to refine the fuel oil, greatly improving its combustion efficiently, greatly restraining the exhaust of gas, and also greatly raising the horse power of the engine. The invention therefore can not merely save energy a great deal but its financial benefit is also great, not to say of its great contribution to prevention of air pollution.

By adoption of annular magnets and placing them side by side in a close line so that the same polarities of their poles can face each other it has been possible to concentrate the line of magnetic force in the opening made in the center of these magnets, which serves as the passage of the fuel oil, and therefore the intensity of magnetism in the opening is greatly raised while the functions-effects of magnetism which the fuel oil undergoes as it flows there is also greatly improved

Also, by turning the lines of magnetic force into membranous beings so that they come to intersect the direction in which the fuel oil flows by their collision with each other in the gaps between the neighboring magnets the intensity of the magnetic field between the neighboring magnets has been raised, the functions-effects of magnets which the fuel oil undergoes being also greatly improved.

Claims

1. A device for refining fuel oil, characterized by arrangement and distribution of a plurality of magnets in a chamber with an inlet and outlet, which serves as the passage for the flow of fuel oil.

2. A device for refining fuel oil according to Claim 1, wherein a plurality of magnets are so arranged in close proximity that their poles can face each other.

3. A device for refining fuel oil according to Claim 1, wherein a hollow, slim, long cylindrical pipe serves as an inner chamber, and a plurality of magnets are so arranged inside said chamber along its length in close proximity that the poles of said magnets can face each other.

4. A device for refining fuel oil according to Claim 3, wherein said magnets are so arranged that the poles of the neighboring magnets facing each other are of the same polarities.

5. A device for refining fuel oil according to Claim 3 or 4, wherein the gaps between the outer circumferential surfaces and the inner surface of said chamber are ready to serve as a channel for passage of fuel oil.

6. A device for refining fuel oil according to Claim 5, wherein retainers of gaps are inserted in the gaps between said magnets and said chamber.

7. A device for refining fuel oil according to Claims 3 to 6, wherein said magnets are annular.

8. A device for refining fuel oil according to Claim 7, wherein long and slim shaft bodies are inserted in continuation in a line, to make one long shaft, in the opening in the center of said annular magnets.

9. A device for refining fuel oil according to Claim 8, wherein gaps are prepared between the inner surface of the opening in the center of said annular magnets and the outer circumferential surface of said shaft for passage of the flow of fuel oil.

10. A device for refining fuel oil according to Claim 8 or 9, wherein retainers of gaps are inserted in the gaps between said magnets and said shafts.

11. A device for refining fuel oil according to Claims 8 to 10, wherein said shafts are made of magnetic material.

12. A device for refining fuel oil according to Claims 3 to 7, wherein small magnets are placed in the center of the gaps between the poles of neighboring magnets so that the poles of said small magnets can face with those of the bigger magnets.

13. A device for refining fuel oil according to Claims 8 to 12, wherein said shaft bodies are of hollow pipes and small magnets are placed inside said shafts positioned between the mutually neighboring magnets so that their poles can face those of the bigger magnets.

FIG. 1

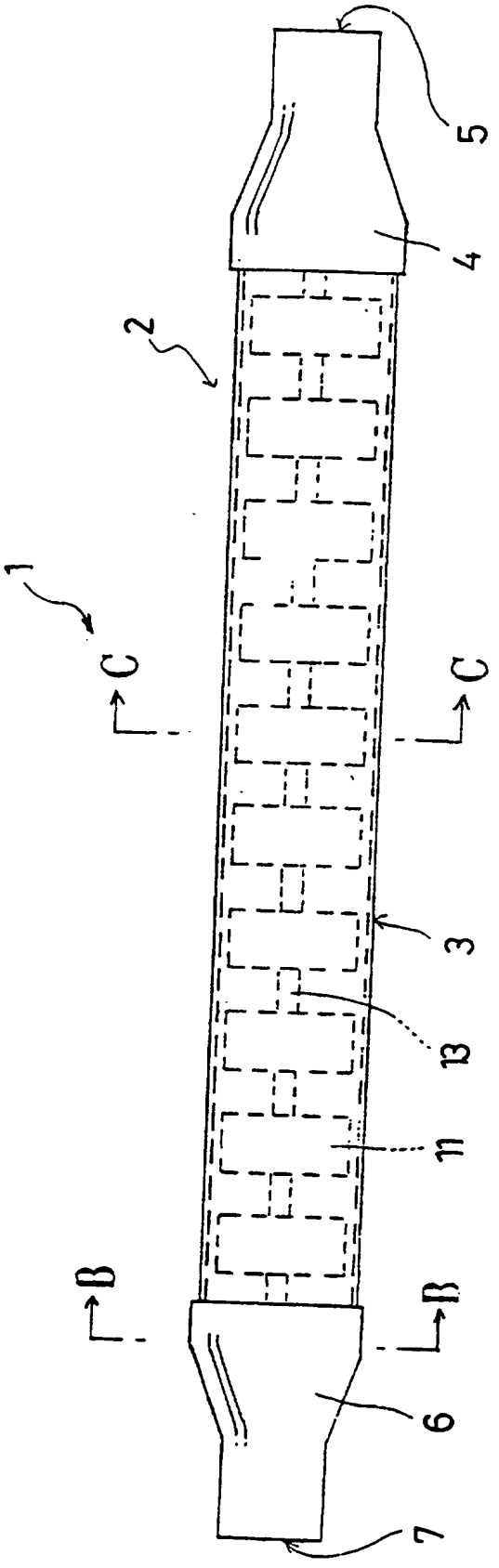


FIG. 2

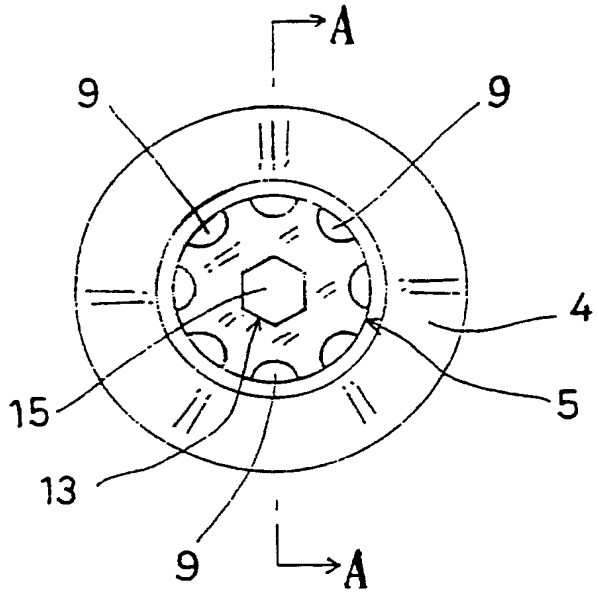


FIG.3

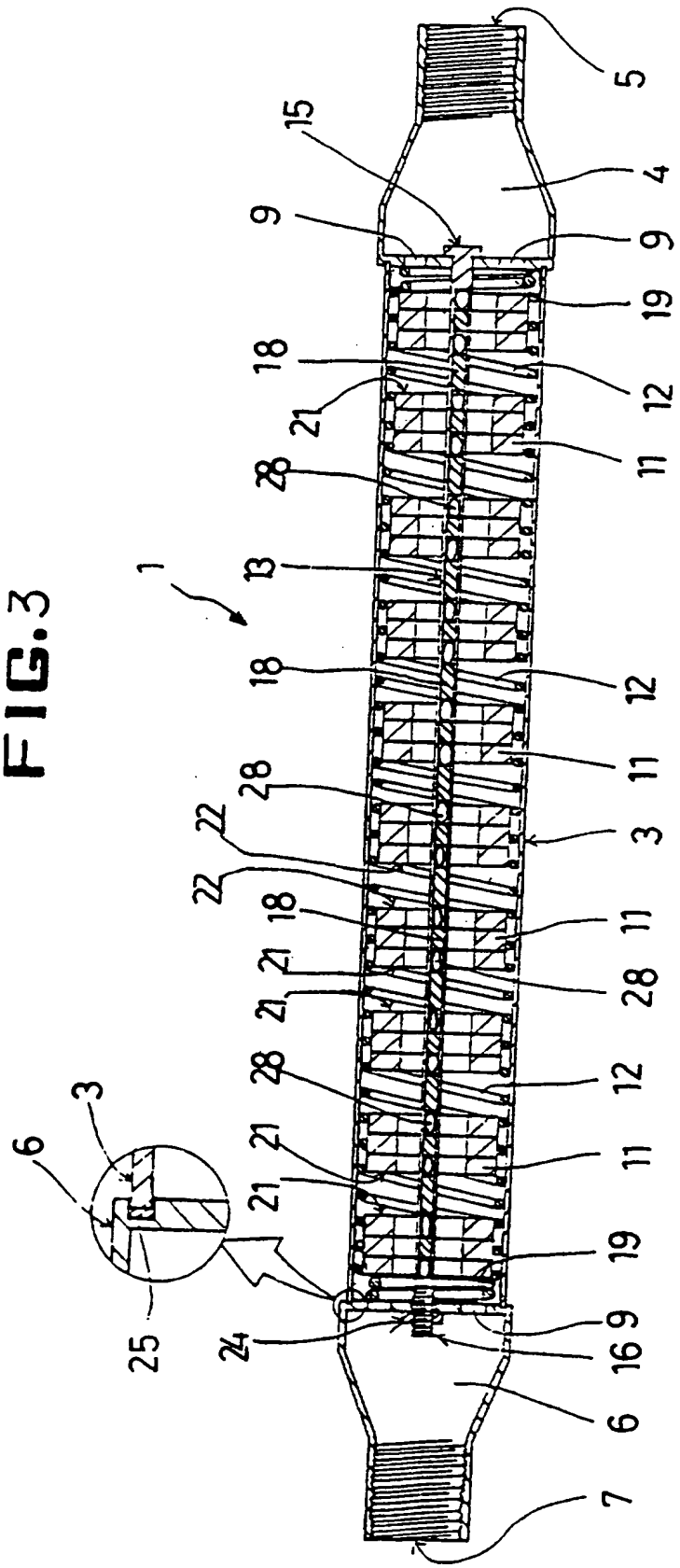


FIG. 4

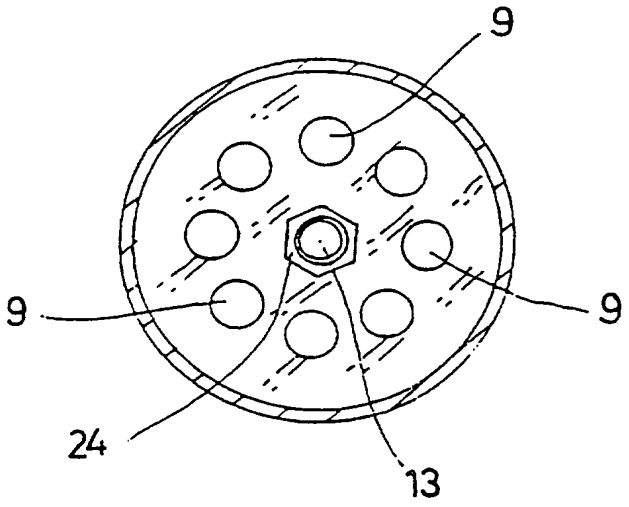


FIG. 5

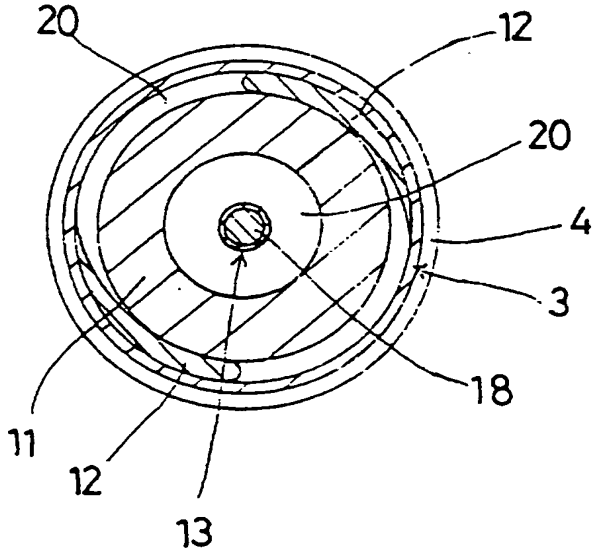


FIG.6

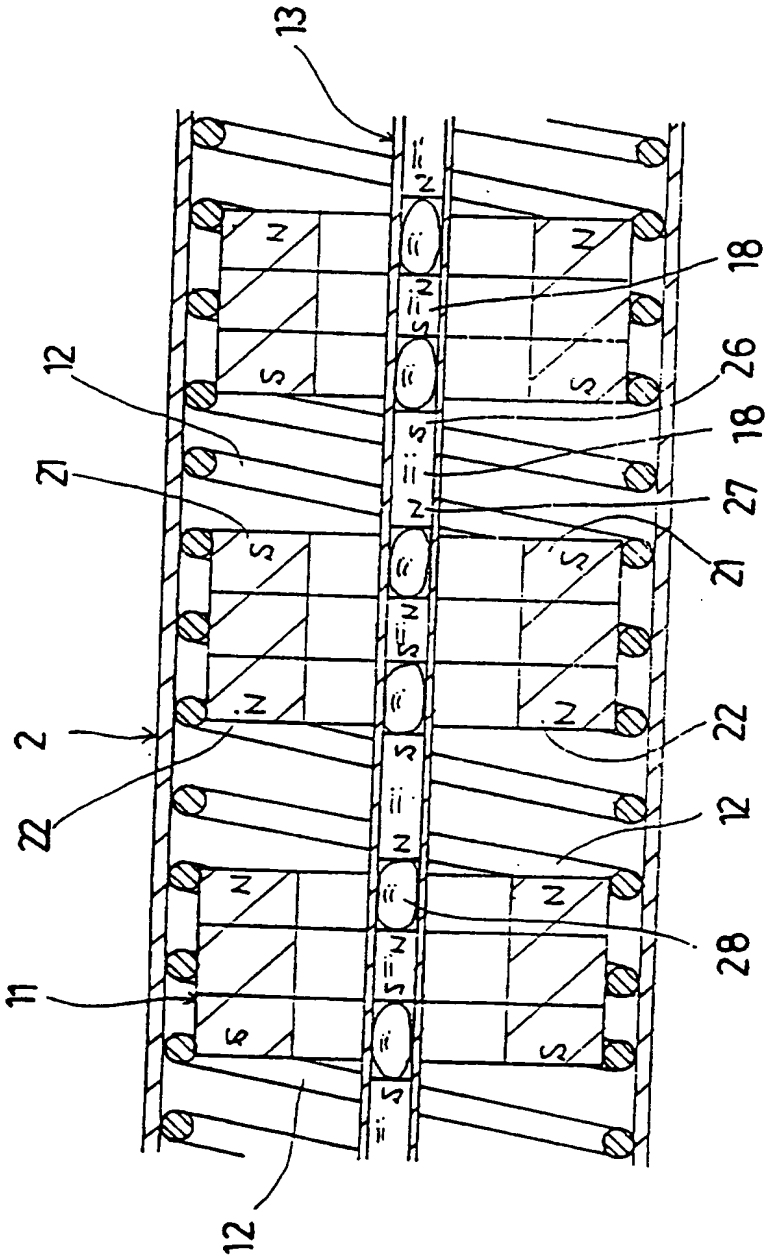


FIG. 7

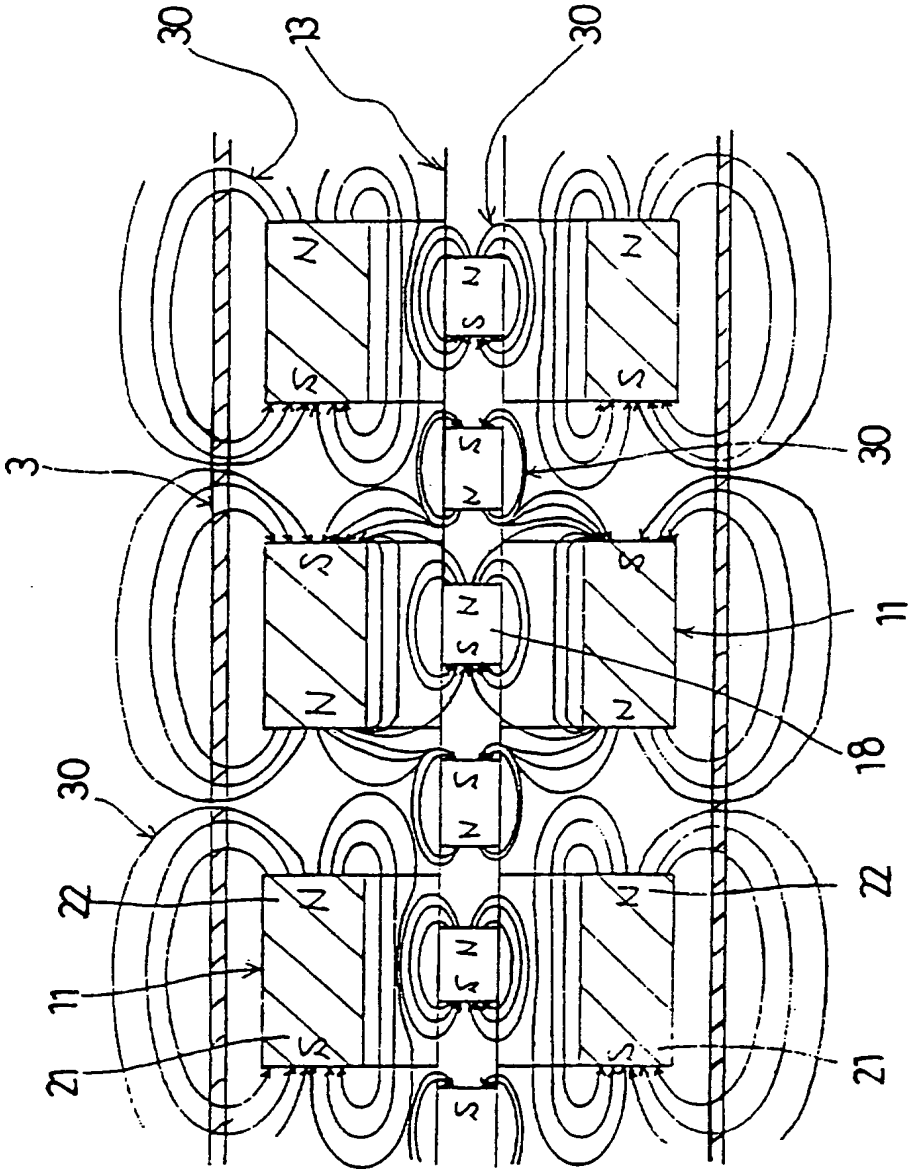


FIG. 8

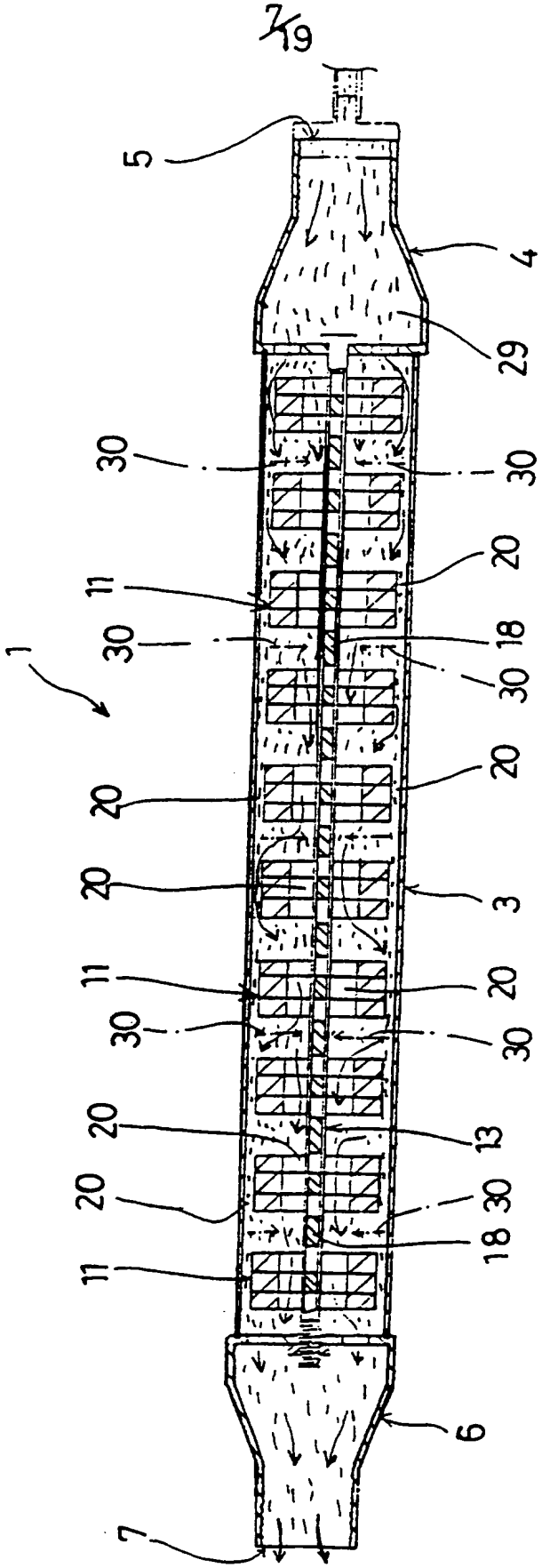


FIG.9

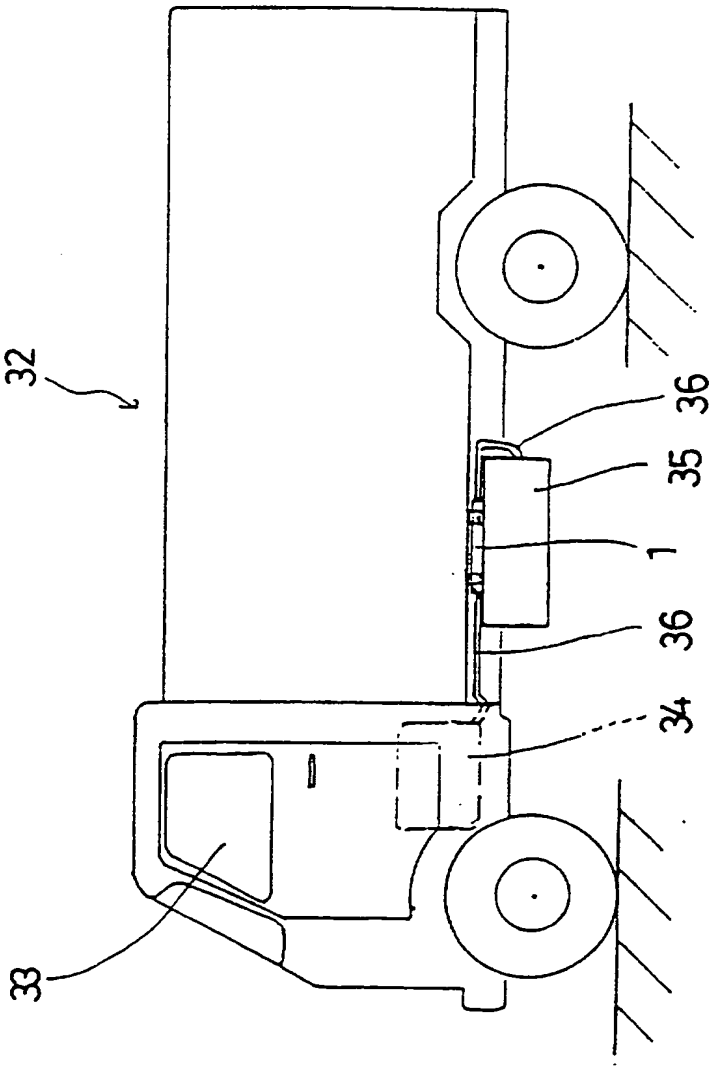


FIG.10

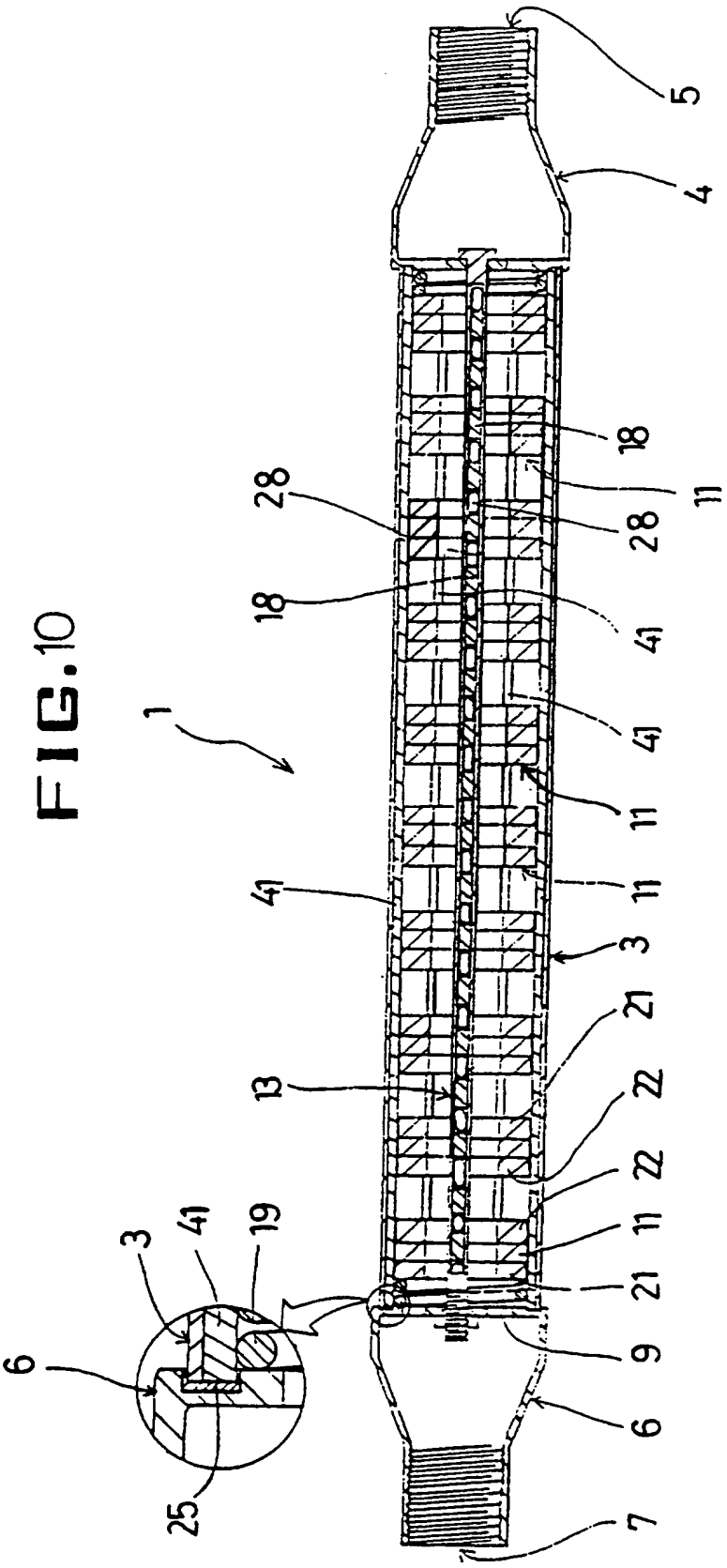


FIG. 11

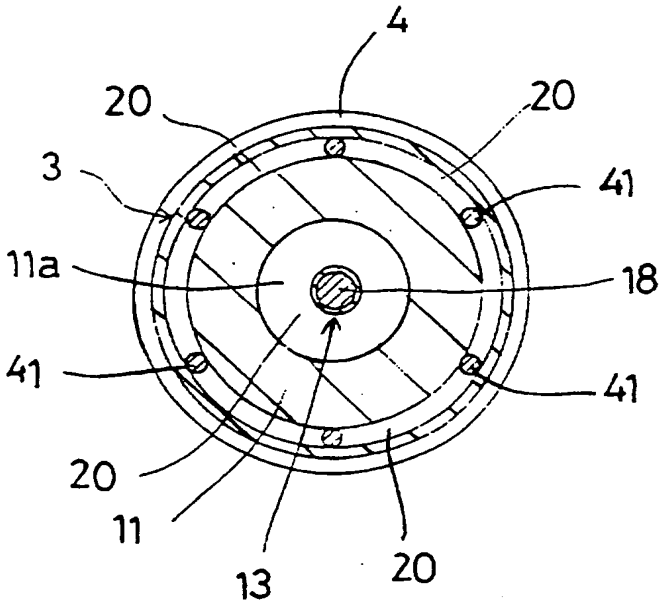


FIG.12

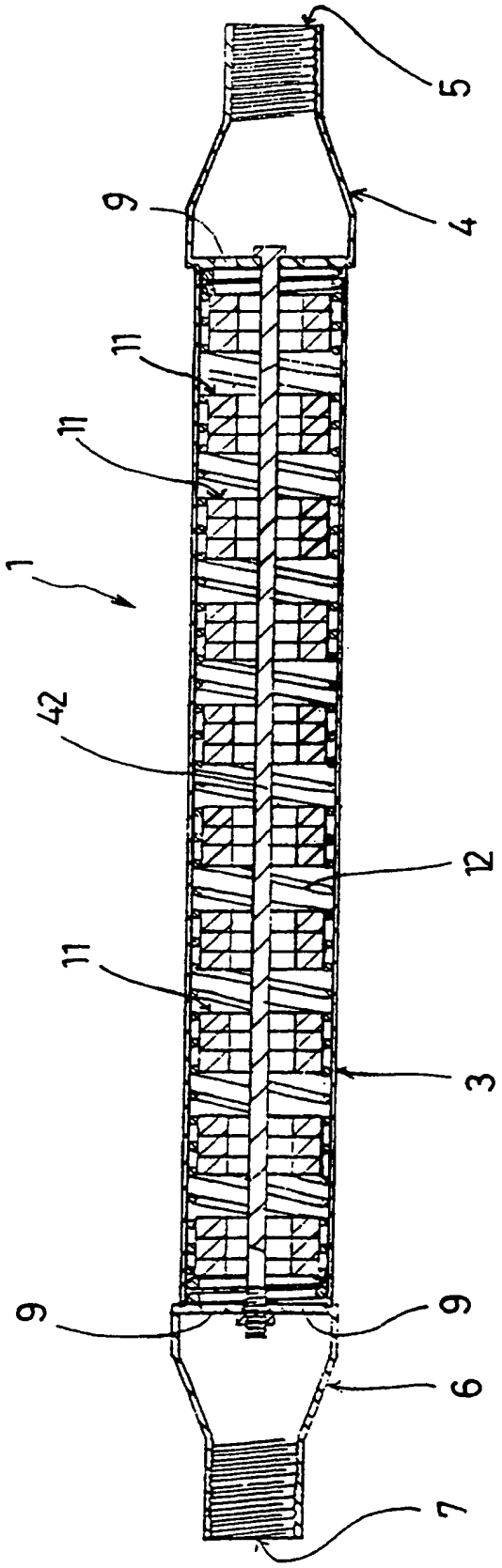


FIG. 13

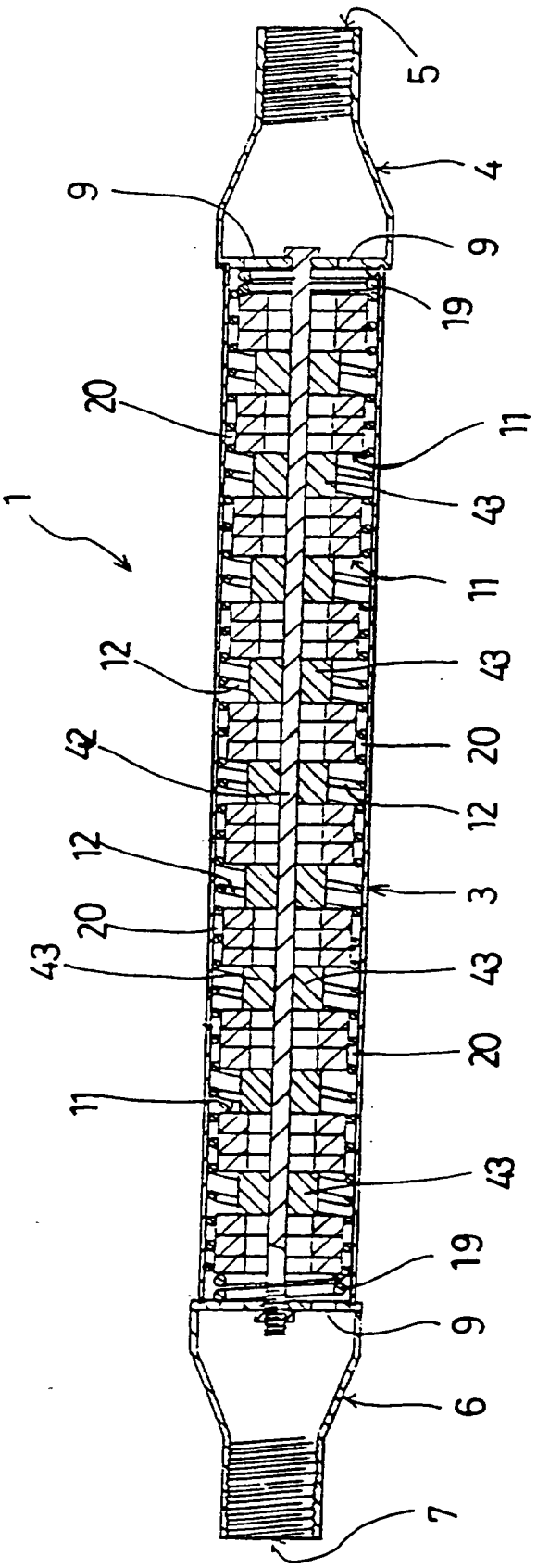


FIG. 14

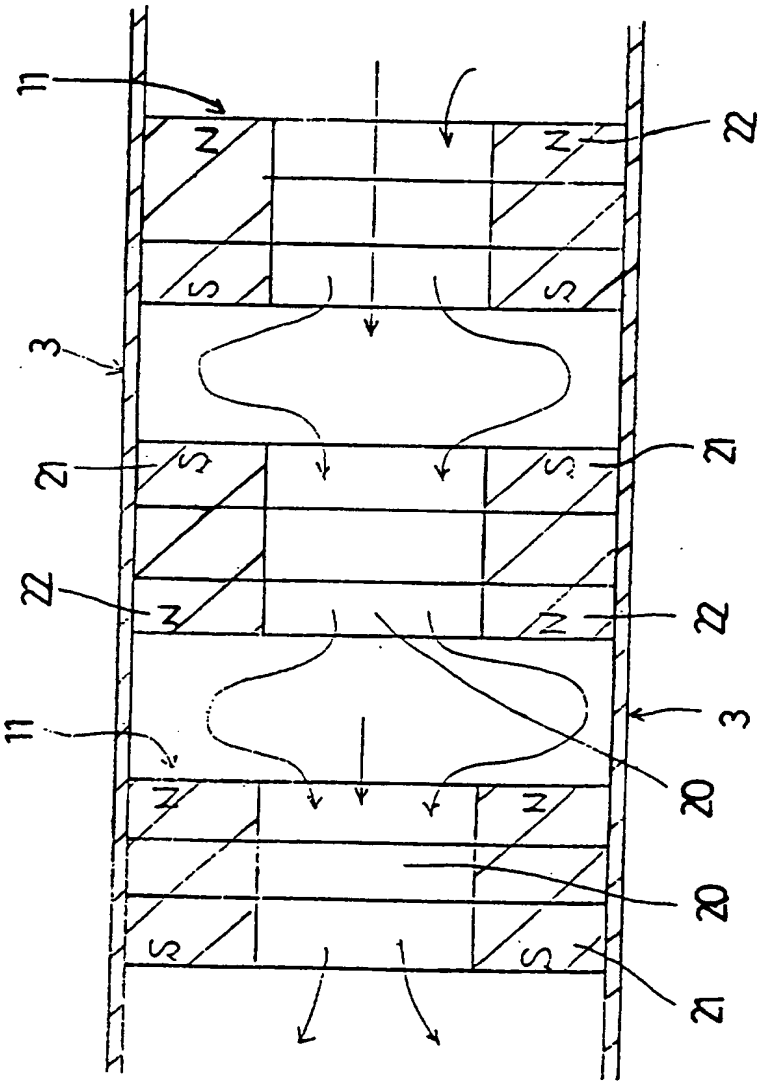


FIG. 15

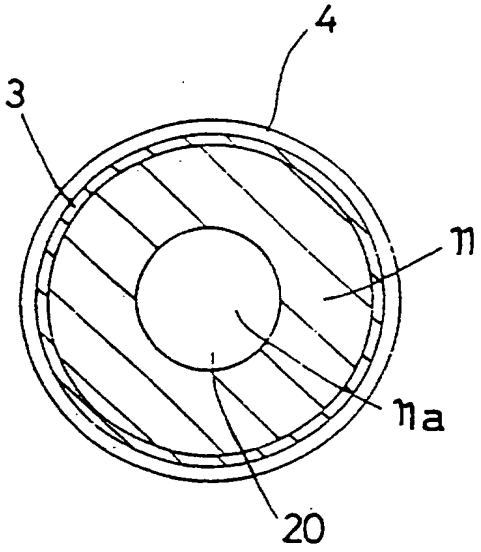


FIG. 16

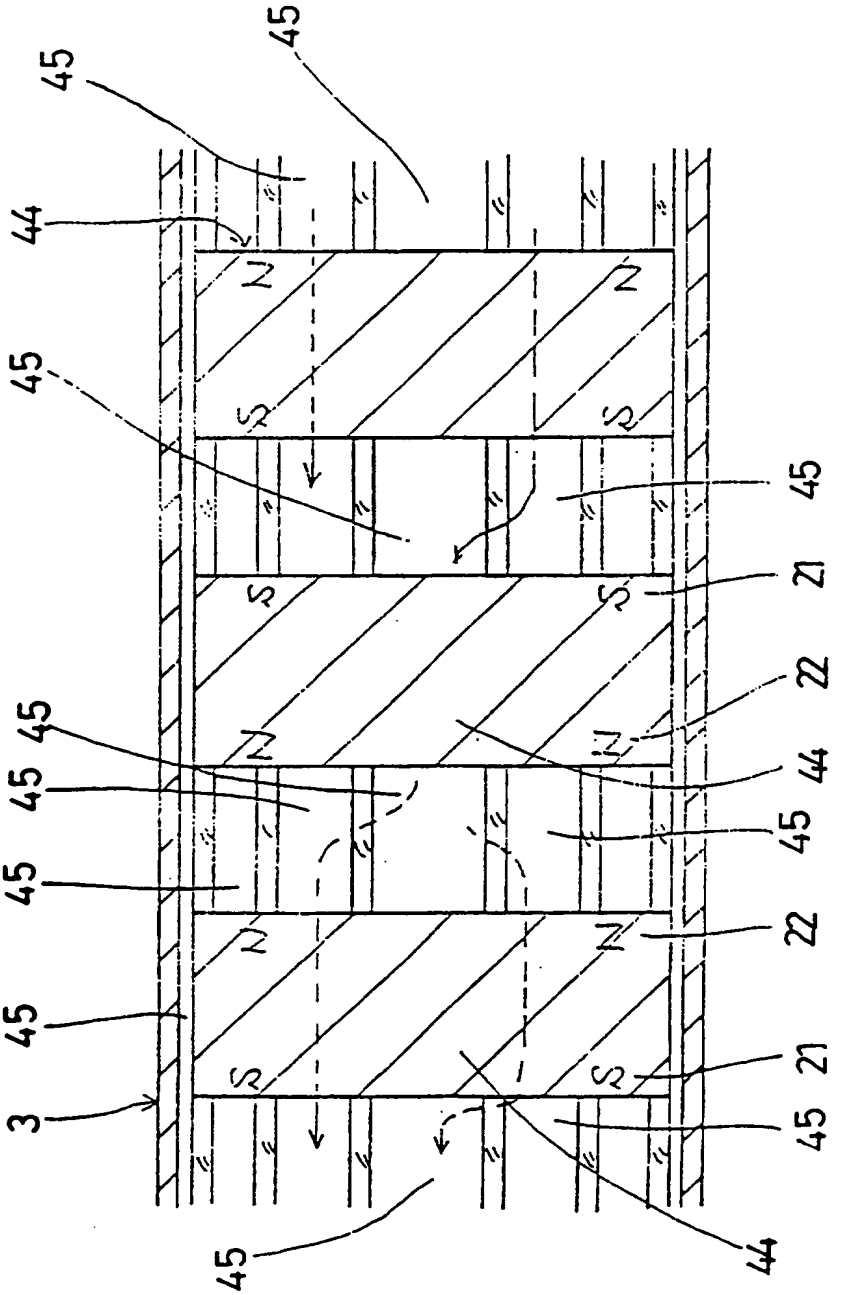


FIG. 17

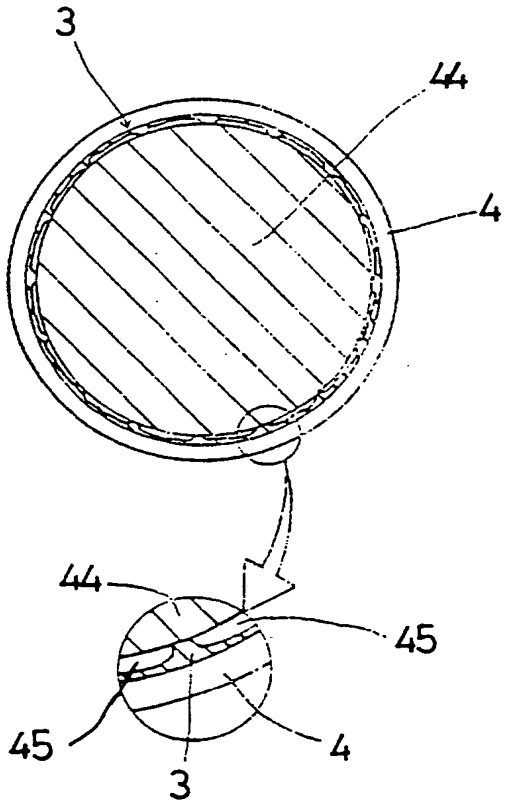


FIG. 18

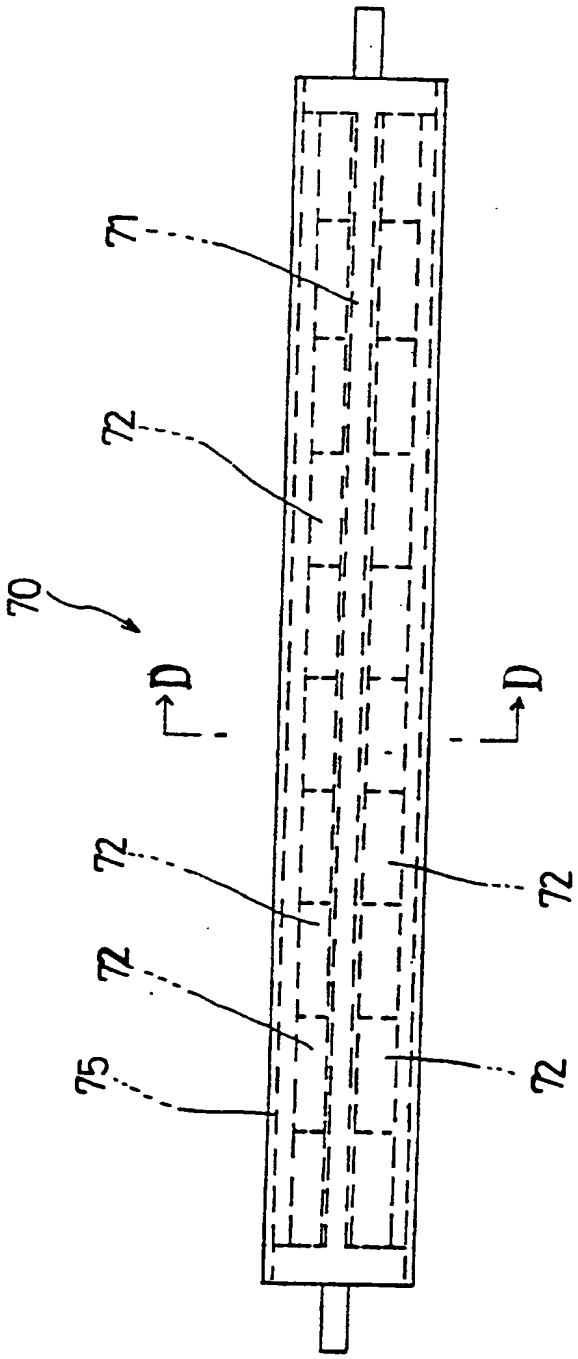


FIG. 19

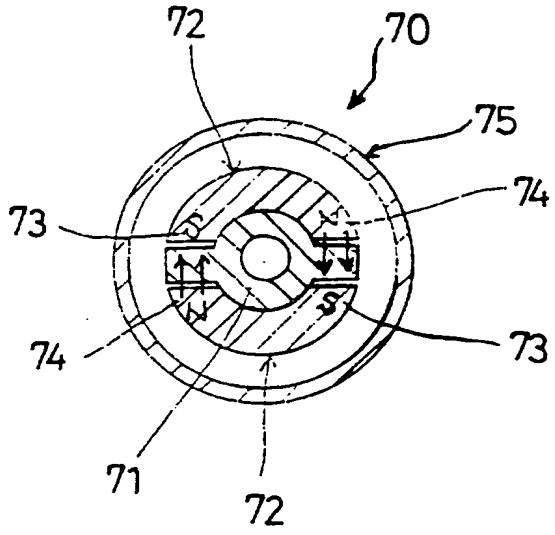
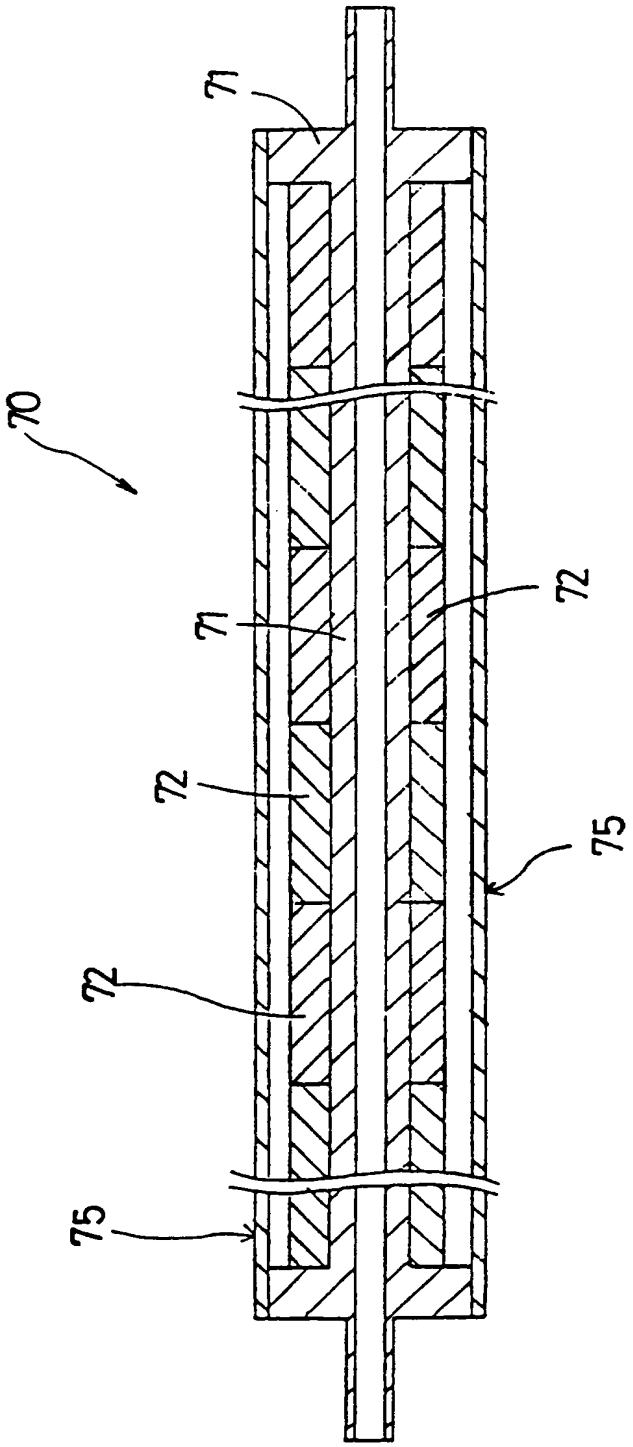


FIG.20



INTERNATIONAL SEARCH REPORT

Internat[illegible] application No.
PC[illegible] 96/00043

A. CLASSIFICATION OF SUBJECT MATTER

IPC[6]: F 02 M 27/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[6]: F 02 M 27/04; B 01 D 35/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 487 370 A (MIYAZAKI) 30 January 1996 (30.01.96), totality.	1-7
X	EP 0 501 589 A1 (HANDELSBURO "ZWOLLE") 02 September 1992 (02.09.92), totality.	1-3,5-7

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 September 1996 (18.09.96)	01 October 1996 (01.10.96)

Name and mailing address of the ISA/ AT	Authorized officer
AUSTRIAN PATENT OFFICE Kohlmarkt 8-10 A-1014 Vienna	Pippan
Facsimile No. 1/53424/535	Telephone No. 1/53424/359

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR 96/00043

In Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
US A 5487370	30-01-96	AU A1 11491/95	17-08-95
		AU B2 670995	01-09-96
		CA AA 2140088	03-08-95
		CN A 1115356	24-01-96
		EP A1 666414	09-08-95
		JP A2 7217507	15-08-95
EP A1 501589	02-09-92	BE AF 1004269	20-10-92